

THE ECONOMIC BENEFITS FROM ASIAN TRADE TO THE AUSTRALIAN ECONOMY

DR. ANANDA KULATUNGA
Researcher
Charles Darwin University of Australia
ananda.kulatunga@me.com

ABSTRACT

The majority opinion in policy circles in Australia is that the Australian economy has substantial benefits from trade with the Asia. However, there are very limited research and analytical studies available in order to substantiate such a claim.

Therefore, this paper is an attempt of carrying out a research and statistical analysis of exports data in relation to Australian exports during the period of 1992 to 2011 in order to ascertain the validity of above claim. The research focused on examining the significance of the influence of Australia's merchandise exports to Asia in relation to Australian Gross Domestic Product.

The research propositions were elicited from an analysis of the economic benefits from Asian trade to the Australian economy. The economic benefits from Asian trade were investigated while bearing in mind a hypothesis. The null hypothesis (H₀) 'Trade with Asian countries does not improve Australian GDP'. This hypothesis was also tested comparing the Australian GDP and Australian merchandise exports to Asia.

A regression model was constructed in order to test time series data collated for the data analysis. If the corresponding p-value of R-Squared statistical value is less than 5 per cent, it is considered as significant. The R-squared value shows the significance of the influence of an independent variable in relation to its dependent variable. However, the regression model was further tested to make sure that the model is free of stationary, that the Dublin- Watson Statistical value is greater than the value of R-squared. Breusch-Godfrey Serial Correlation LM Test and Breusch-Pagan-Godfrey heteroskedasticity test is carried out to check whether the regression model has no serial correlation in its residuals. If the residuals are subject to serial correlation, then the first difference method was applied in order to remove serial correlation from the residual. The Histogram Normality test was carried out to check whether the residual is normally distributed. If the Jarque-Bera value and the correspondent probability are high, then the regression model is considered as it has a normally distributed residual.

The statistical test results revealed that the Australian merchandise exports to Asia had a significant impact on the Australian GDP during this period 1992 to 2011.

Key words: Merchandise Exports, Gross Domestic Product and Regression Model

Category 1 *THEORY OF ECONOMIC POLICY*

JEL Classification Code: *C12*

Acknowledgements: The author is grateful to Dr Siva Velayutham, Dr Bala Nadarajah and Dr Susan Bandias of Charles Darwin University for their support and to the staff of the Department of Foreign Affairs and Trade, Austrade and the Northern Territory Treasury for their help in providing relevant materials and also appreciate the help received from the staff attached to Charles Darwin University library in literature and referencing search for this paper.

THE ECONOMIC BENEFITS FROM ASIAN TRADE TO THE AUSTRALIAN ECONOMY

1.1. Introduction

The main purpose of this paper is to examine the economic benefits from Asian trade to the Australian economy. The paper focused on a broad areas to examine the significance of the influence of Australia's merchandise exports to the Asia in relation to the Australian gross domestic product.

The demand of Asia is highlighted in the trade matters of Australian Government Department of Foreign Affairs and Trade (DFAT 2012). The main driver of demand for Australia's commodities has been the rapid urbanization and industrialization of emerging economies in Asia, particularly China and India. Intensified steel making in Asian countries, as well as the higher consumption of energy, substantially drove up commodities prices in the 2000s. Between 2003 and 2011, global prices for Australia's resource exports (in US dollar terms) increased by more than 300 per cent. Australia's iron ore and coal industries, which provide the principal ingredients in steel production, benefited considerably. These activities yielded an average annual growth rate of 36 per cent for iron ore and 17 per cent for coal between the period 2007 to 2011 (DFAT 2012).

Australia's economic interest by trade with Asia is explained in year-book published by Australian Bureau of Statistics (ABS 2007), that the trade investments are vital to Australia's economic prosperity. Over 1.7 million Australian jobs are directly or indirectly connected to exports. Australia is pursuing an ambitious trade policy agenda, which combines multilateral, regional and bilateral strategies to open new markets, reduce barriers to trade and promote Australian goods and services.

There are several explanations for the increase in Australia's exports to Asia. Firstly, there is Australia's proximity to the Asian region, which makes transporting bulky export commodities: coal, minerals, wheat, wool, much cheaper than other countries (Knight and Heazlem 2011). Secondly, there is a rapid development of the economies in the Asian region. Their unprecedented economic growth from the 1960s to the 1990s and China's sustained growth in income in more recent years have fuelled a strong, ongoing demand for Australia's resource based commodities (Knight and Heazlem 2011). Thirdly, shifts in Australian government policy have increased Australia's trade dependence on Asia. From 1980s, economic protection of Australian industries was scaled back, and trade liberalisation fostered (Knight and Heazlem 2011).

Trade generates jobs and a better standard of living for all Australians. In fact, around one in five Australian jobs are directly or indirectly connected to exports. In regional Australia the exports and imports link is even stronger, around one quarter of regional jobs relying on Australia's ability to export (ABS 2012).

1.2 The Issue

The majority opinion in policy circles in Australia is that the Australian economy has substantial benefits from trade with the Asia. As a result, Australian government and the businesses are making their business decisions on the myth of great benefits from trading

with Asia. However, there are very limited research and analytical studies available in order to substantiate such a claim.

Therefore, this paper is an attempt of carrying out a research and statistical analysis of merchandise export data in relation to Australian exports during the period of 1992 to 2011 in order to ascertain the validity of above claim.

1.3 Objective of the study

The objectives of this research study are:

To examine the significance of the influence of Australia's merchandise exports to the Asia in relation to the Australian gross domestic products during 1992 to 2011.

1.4 Hypothesis

H0 - Trade with Asian countries does not improve Australian GDP.

1.5 Methodology, scope of the study and data sources

Quantitative mode of investigation was employed in this research study.

A wide range of statistical data are consulted and analysed. An appropriate regression model was constructed with relevant test criteria to validate test results.

The study is an examination of the statistics of Australia's merchandise export revenue from Asia during the period 1992 to 2011. The expenditure method of calculation of gross domestic product is considered in order to test null hypothesis (H0): 'Trade with Asian countries does not have an impact on the Australian GDP'. The GDP equation as follows;

$$GDP = C + I + G + (X-M)$$

Where,

C = Consumption

I = Investment

G = Government expenditure

X = Exports

M = Imports

The significance of merchandise exports to Asia (X) in relation to the Australian GDP was tested.

Secondary information was sourced from available relevant publications. Some of the publications are sourced from the Australian Bureau of Statistics, the Department of Foreign Trade, the Reserve Bank of Australia and other journals and paper articles. A range of books dealing with aspects of Asian trade was consulted in order to gather further important information.

The full range of economic data available for comparative analysis is discussed, including limitations on the use and exclusions due to confidentiality requirements and unavailability time series data. The process of comparing and contrasting the economic data of a number of key export industries/sectors was carried out to demonstrate the relative performance and significance of selected industries/sectors of all States and Territories in the country.

E-views statistical package is used for analysing and testing relevant data. Excel spread sheets are used for collating and reconstruction of data sets for necessary formats to facilitate the statistical package.

1.6 Significance of the study

The Australian Government's wide-ranging economic reforms have strengthened the international competitiveness and export performance of Australian industries during past few decades. Export growth has been strong, and the direction and composition of Australia's exports have become more diverse. Strong export growth has, in turn, made a positive contribution to the growth of the Australian economy. Gross Domestic production has been increased at an increasing trend from US\$944.8bn, US\$1,033.5bn, US\$976, US\$ 1,242.1bn and US\$1,487.4bn in the years from 2007 to 2011 respectively (DFAT 2012). Economic reforms have positioned Australia to cope well with the advent of globalisation and to absorb external shocks.

At present in broad terms, the Asian economies are emerging from the monetary crisis of the mid-nineties and are again becoming a focus for foreign investments especially in developing countries in the region (Feldstein 2003). Today, Asia is the fastest growing regional market particularly for manufactured goods. However, the South-East Asian countries depend on imported materials for their export oriented production. Australia's fastest growing export sector is products leading to manufacturing industries such as iron, steel and other minerals, computers and office equipment, transport equipment, automotive products and electrical machinery (World Bank 2009).

There are a number of countries in the Asian region that have trade alliances and free trade agreements (including Singapore and Thailand) with Australia (Kawai and Wignaraja 2011). Foreign trade would result in a favourable, deficit or balanced trade between the countries engaged in the trade. Therefore the proposed research study is an attempt to ascertain the extent to which Asian trade contributes to the Australian economy in its growth strategy. Further, the study is aimed in arriving at a fair conclusion by examining whether a nexus exists between economic growth in Australia and the strategy of trading with Asian countries.

2.1 Background Information and Literature Review

Australia recognises Asia's great diversity (Yaw 2001). Asian countries differ in their political and economic systems and in their stages of development as well as in their cultures and traditions. These differences define the individual countries' interests and approaches to domestic, regional and global issues. Australia has revamped its economy in recent years and become more internationally oriented (Edwards 1996). Australia has been conducting economic trade with various Asian countries (Scott 2011). The economy has been converted from one that largely inward looking, fiercely protective and heavily dependent on a relatively narrow range of agricultural and mining products to one that is open, highly competitive and outwardly focuses, particularly on the high growth markets of its Asian neighbours (Edward 1996).

Adam Smith broke with the mercantilist tradition when he argued that free trade is the best policy for all trading countries (Barbara 2004). He based his arguments of the gains from trade on absolute cost differences. Each country should specialise in the commodities, which it could produce more efficiently than other countries and import commodities, which it would produce less efficiently. Ricardo was later to widen the scope of analysis to take account of comparative cost differences (Barbara 2004).

Export patterns have changed in recent decades. Exports grew much faster in the 1990s than in the two previous decades. The average annual growth rate of real exports of goods and services was 8.1 per cent in the 1990s compared to 4.1 per cent in the 1980s and 5.3 per cent in the 1970s. By contrast, on an annual average basis, real GDP grew by 3.5 per cent in the 1990s, 3.3 per cent in the 1980s and 3.5 per cent in the 1970s (Rodney & Ross 2004).

2.2 Previous studies in relation to export trades

This section reviews the existing literature that deals predominantly with relationship between export trades.

Most of the empirical studies of international trade flows have concentrated on the demand side for exports, assuming perfect or very high price elasticity for exports on the supply side. However, Khan (1974) and Goldstein and Khan (1978) pointed out that unless export production is subject to constant or increasing returns to scale, an increase in the demand for a country's exports cannot be met without generating a rise in the price of exports. Hence Goldstein and Khan (1978) considered explicitly a simultaneous equation model of export demand and supply. Based on the estimated demand and supply price elasticity for developed countries, Goldstein and Khan (1978) concluded that the price elasticity of demand for exports varies once export supply relationships are explicitly taken into account. While Goldstein and Khan (1978) reported income elasticity that is similar to those in other studies, the price elasticity estimates were significantly higher.

Senhadji and Montenegro (1998) estimated price and income elasticity of the aggregate export demand for fifty-three industrial and developing countries. They stressed that the price variable should include both the export price facing the exporting country and the domestic price of each importing country. Senhadji and Montenegro (1998) modified the commonly used specification of the export demand equation by defining the activity variable as the weighted average of GDP minus exports of the importing countries. The results of Senhadji and Montenegro (1998) indicate that although exports respond to changes in both the relative price and income, the magnitude of the response is small. The average price elasticity is close to zero in the short-run, but is about one in the long run. The estimated average short-run income elasticity is less than 0.5 and the long-run income elasticity is close to 1.5.

Using the simultaneous equation approach, Arize (1987) estimated export demand for eight African countries for the period 1960-1982. He reported a rather weak sensitivity of export demand to export prices. However, Koshal et al. (1992) estimated a simultaneous supply and demand equation model for Indian exports over the period 1960-1986 and found that the demand for exports was responsive to price changes.

Muscatelli and Srinivasan (1992) estimated a simultaneous demand and supply model for exports of newly industrialising economies (NIEs), using the two-stage least squares procedure, and estimated the long run demand and supply relationships. They presented some new empirical estimates for the demand and supply of exports of manufactures from Hong Kong. The results provided different signs from those obtained in previous studies on Hong Kong. Hong Kong as a small economy would face a low price elasticity of demand for its exports and face demand-constraints in its export markets. The estimated income elasticity of export demand is high, conforming to a pattern found in most fast-growing economies, whether in the developed or the developing world.

Athukorala and Riedel (1991) maintain that if the demand equation is normalised in prices, it is possible to test the small country hypothesis that demand is perfectly elastic with respect to price. Athukorala and Riedel found that in the case of Korean exports of machinery and

transport equipment, an export demand equation normalised in prices supports the small country hypothesis, whereas the equation specified in quantities was associated with a low price and a high income elasticity of demand for those commodities. Warr and Wollmer (1996) tested the proposition of Athukorala and Riedel (1991), for the case of export demand for the Philippines coconut products. Using the specifications of all three versions (a quantity, a price and a relative price normalised demand equation) the hypothesis that the Philippines is a small country exporter of coconut products was rejected. However, Warr and Wollmer acknowledged that a contradictory outcome might be due to the fact that the Philippine is a major exporter of coconut oil.

Mahmood (2002) examined the export demand for Australia's processed foods in Japan estimating a single equation model. He assumed export demand to be a function of a price term, an income term, and the exchange rate. He found that all the price coefficients had expected negative signs, except dairy products for which the price term was insignificant, and therefore omitted. Based on the estimated elasticity, the demand for Australia's processed foods, except dairy products, in Japan is price inelastic, and income elasticity is very high, except for dairy a product that has income elasticity below one. All of the exchange rate elasticity has expected negative signs and the exchange rate has a significant influence on export demand.

Gunawardana and Karn (1998) estimated an export demand function for Australian pharmaceuticals, with Australia's export price relative to competing countries' export price and total real income of countries importing pharmaceutical products from Australia as independent variables. They concluded that in the short run, export demand is not responsive to either relative price or foreign income. However, the long run coefficients for relative price and real income have expected signs and are significant at the one per cent level. The long run price elasticity of demand of -1.06 indicates that a one per cent increase in Australia's export price relative to competitors' export price will result in a 1.06 per cent decline in the real exports of pharmaceuticals by countries that import this product from Australia. The long run income elasticity of 2.56 indicates that a one per cent increase in real income of importing countries will increase the demand for pharmaceuticals exported by Australia by 2.56 per cent. Sawyer and Sprinkle (1997) also concluded that the estimation of the demand for exports relate changes in the quantity of exports to changes in income and relative prices.

Sharma (2003) estimated export demand and supply function for India using the two-stage least squares procedure. In the export demand model, Sharma included real effective exchange rate (REER), relative export price, world income, and lagged exports as independent variables. He found that the world income to be insignificant and re-estimated the export demand model. The REER and relative export price were found to have significant negative impacts, while lagged exports had significant positive impact on export demand. In the export supply model estimated by Sharma, relative export price, lagged exports and the time trend were found to have significant positive impacts, whereas the domestic demand pressure had a significant negative impact on export supply.

In their model of the determinants of Chinese export performance, Muhammad and Ma (2008) included, in addition to foreign (trade partners') income and relative export price, the labour productivity and foreign direct investment (FDI). Muhammad and Ma were concerned with aggregate exports (not commodity specific exports) and ignored the role played by industry protection and government assistance in export performance. These authors found that foreign income had the most significant positive impact on Chinese export performance, followed by the negative impact of relative price. The labour productivity and FDI variables had smaller but positive impacts on Chinese export performance.

Athukorala (2000) examined the terms of trade implications of diversification into manufactured exports in a traditional primary-exporting country in the light of the Sri Lankan experience. The empirical analysis focuses trend in both commodity and income terms of trade, employing a methodology which takes care of the ‘spurious regression’ problem. The majority opinion in policy circles in developing countries and within the international policy community is that primary-exporting developing countries can achieve terms of trade gains through diversification into manufacturing exports. This view is often rationalised on the basis of the Prebisch-Singer thesis that postulates a structural tendency for the net barter (or commodity) terms of trade (NBTT) of primary commodities in world trade to deteriorate relative to manufactures (Prebisch, 1950; Singer, 1950).

The debate is centred on two main hypotheses. Firstly, ‘the Singer hypothesis’ is an adoption of the old Prebusch-Singer thesis. Prebisch (1950) and Singer (1950) present four explanations of the long-run deterioration in the NBTT between primary products and manufactures. These are;

- a. Lower price and income elasticity of demand for primary products than for manufactured goods.
- b. Technical progress that economises on the use of primary raw material in the manufacturing process.
- c. Technological superiority of developed countries and the control exercised by multinational enterprises based in these countries on the use of sophisticated manufacturing technology.
- d. Monopolistic market structures in developed countries combined with competitive conditions in both commodity and labour markets in developing countries.

Of these, the first two factors are essentially ‘commodity specific’ and Singer (1987) argues that a shift from primary commodities to manufactures would lead to a terms of trade gain. By contrast the remaining two factors are ‘country specific’ and are presumably relevant in determining the NBTT of both primary commodities as well as manufactured exports by developing countries.

3.1 Methodologies and Data Collection

The research propositions were elicited from an analysis of the economic benefits from Asian trade to the Australian economy. The economic benefits from Asian trade were investigated while bearing in mind the hypothesis. The null hypothesis (H0) ‘Trade with Asian countries does not improve Australian GDP’. This hypothesis was tested comparing the Australian GDP and Australian merchandise exports to Asia.

Given the lack of previous studies on this particular topic and its anomalous nature to normal trends, it was a difficult task to establish a theoretical construct which made inductive theory building to a relevant methodological process. The introduction of an input variable to the established theoretical framework also required more theory building exercises rather than straight deductive testing. For this research equality was given to the quantitative and qualitative techniques. Rather than taking the view that quantitative testing and qualitative analysis, took the view that qualitative analysis provides a deeper insight into quantitative findings. The research began with qualitative analysis followed by quantitative analysis as in the normal process, but then further qualitative analysis was undertaken to further inform the

study. A brief overview of the methodological process will be outlined here before a more detailed discussion of each part of the process. The research began with inductive theory building as in the normal methodological process; however, it initially entered the field with some limited theoretical constructs in mind but took care to prevent biasing the fieldwork. The holistic case of Australian merchandise exports to the Asian region against Australia's total merchandise exports was first analysed with the use of quantitative techniques. Secondary data was collected and analysed to develop an understanding of the export trade and its benefits to the Australian economy. The secondary data was collected from the reliable, official source of Australian Bureau of Statistics.

The next stage of research was more deductive as specific theoretical constructs were tested but with mixed quantitative data and published information. Secondary information was collected from reliable sources such as the Australian Bureau of Statistics, Department of Foreign Affairs, Trade and relevant periodic publications of Treasuries in Australian States and Territories.

The final stage of research veered away from the traditional inductive/deductive process by returning to qualitative techniques which were used to further inform the analysis from the initial quantitative testing and to add rigour. The most informative part of the data collection and analysis was a focused study of a merchandise export industry and its contribution from the Asian region. The quantitative testing was used to inform an overall analysis of the case but published information were then used to more rigorously analyse the case and increase the validity of the research in a change from the normal pattern used in research.

The assumption that the future will be like the past is an important criteria in time series regression. Therefore it is given its own name 'stationary'. Time series variable can fail to be stationary in various ways, but two are especially relevant for regression analysis of economic time series data (Stock & Watson 2003):

1. The series can have persistent long-run movements that demonstrate that the series can have trends.
2. The population regression can be unstable over time. That is, the population regression can have breaks in the time series.

The above departures from stationary forecasts and inferences are based on time series regressions.

The standard empirical approach in the statistical debate on trade data with two variables is to estimate a log-linear trend equation of the form:

$$X_t = \alpha + \beta T + \mu_t \quad (1)$$

Where, X is the logarithmic value of the merchandise export data series. T denotes time and μ_t is the disturbance term. The coefficient β indicates the average compound rate of improvement ($\beta > 0$) or deterioration ($\beta < 0$) of impact of merchandise export revenue from Asia to total merchandise export revenue.

The estimate of β based on model (I) is valid only if X is stationary around a deterministic trend (that is if X is a trend stationary (TS) process).

If X is non-stationary, that is it fluctuates widely around a mean level that itself changes quite often, OLS estimator does not have finite moments and is not consistent, and tests or a time trend are biased, finding one when none is present (Nelson and Kang, 1984). In other words, results based on a simple trend fitting are potentially subject to a 'spurious regression' problem due to the incorrect treatment of the statistical properties of the series.

Cuddington and Urzua (1989) were the first to raise the 'spurious regression' issue in the context of the statistical debate on the terms of trade. To redress the problem, they adopted a two-step approach under which the data series is first formally tested (using a standard unit root testing procedure) to identify whether it belongs to the TS class. If the series is found to be TS, then the use of the conventional trend specification (Equation 1) is justified. Otherwise, a difference stationary model is estimated under the implicit assumption that first differencing ensures stationary status. The difference stationary counterpart to Model (1) is:

$$X_t - X_{t-1} = \beta + e_t \quad (2)$$

where, β is the (fixed) mean of the differences and e_t is assumed to be a stationary series with zero mean and variance σ^2 .

Bleaney and Greenaway (1993) employed a more general error correction specification of the trend equation that encompassed both trend stationary and difference stationary models (Equations 1 and 2). Instead of prior testing of the time series properties of the data series, this method aims to minimise the possibility of uncovering a spurious trend by appropriately allowing for possible dynamics involved in the determination of the trend rate. This approach is presumably more appropriate for this field of studies, given the low power of unit-root tests for small data samples. It also does not rest on a prior assumption regarding the stationarity of the first differences.

This study has adopted this approach, the estimation procedure starts with an over parameterised autoregressive distributed lag (ADL) specification of equation (1).

$$X_t = \alpha + \beta T + \sum_{i=1}^m EX_{t-i} + \mu_t \quad (3)$$

Where α is a constant, X_t is a $(n \times 1)$ vector of endogenous variables, and E is a $(n \times k)$ matrix of parameters. Equation 1 is then re-parameterised in terms of differences and lagged levels so as to separate the short-run and long-run multipliers of the system:

$$\Delta X = \alpha + \beta T + \sum_{i=1}^{m-1} E^* \Delta X_{t-i} + \Phi X_{t-m} + \mu_t \quad (4)$$

where,

$$\Phi = -[1 - \sum_{i=1}^m E^*]$$

and the long-run trend rate of terms of trade is $B = -\beta\Phi^{-1}$

Estimates of equations (3) and (4) will yield identical results, but (4) is the more convenient form, particularly when it comes to addressing the problem of serial correlation. If the

estimation of (4) exhibits serial correlation, this can be redressed by the inclusion of one or more lags of the dependent variable as regressors (with the appropriate lag determined as part of the estimation process). Thus, equation (4) is used as the ‘maintained hypothesis’ of this specification search. This general model is ‘tested down’ (using OLS), by dropping statistically insignificant lag terms and imposing data-acceptable restrictions on the regression parameters. The testing procedure continues until a parsimonious error correction representation is obtained which retains the *a priori* theoretical model as its long-run solution. To be acceptable, the final equation must satisfy various diagnostic tests relating to the OLS error process.

In the estimation of (4), if $\beta \neq 0$ and $\beta < 0$, the terms of trade has a deterministic trend. That is, it has a long-term tendency to revert to a non-zero trend following any short-term disturbance. If $\beta \neq 0$ and $\Phi = 0$, the terms of trade is a random walk with drift (that is, it has a stochastic trend). This means it is possible that the impact of trade revenue from Asia to the total merchandise export revenue will be greater (if $\beta > 0$) or less (if $\beta < 0$) than its current value in the future. Thus, both ‘ $\beta < 0$ and $\Phi = 0$ ’ and ‘ $\beta < 0$ and $\Phi < 0$ ’ provide empirical support for the deteriorating trend hypothesis. The important methodological point here is that if one erroneously applies the conventional trend stationary model (Equation I) to a series which is in fact a DS process, the results may spuriously support the Singer hypothesis even if in reality the series is characterised by ‘ $\beta > 0$ and $\Phi = 0$ ’ or ‘ $\beta = 0$ and $\Phi = 0$ ’.

Regression models of this research study were tested with the following criteria in order to accept the model for data analysis.

The R-squared (R^2) statistic measures the success of the regression in predicting the values of the dependent variable within the sample. In standard settings, it may be interpreted as the fraction of the variance of the dependent variable explained by the independent variables. The statistic will equal to one if the regression fits perfectly and zero if it fits no better than the simple mean of the dependent variable. It can be negative for a number of reasons. For example, if the regression does not have an intercept constant, if the regression contains coefficient restrictions, or if the estimation method is two-stage least squares or autoregressive conditional heteroskedasticity (ARCH).

R-squared computed as,

$$R^2 = 1 - \frac{\sum \hat{e}_t^2}{(y - \bar{y})(y - \bar{y})}; \bar{y} = \sum_{t=1}^T y_t / T$$

where, \bar{y} is the mean of the dependent (left-hand) variable.

Serial Correlation least square (LM) Test is an alternative to the Q-statistics for testing serial correlation. The test belongs to the class of asymptotic (large sample) tests known as Lagrange multiplier (LM) tests.

Unlike the Durbin-Watson statistic for autoregressive (1) errors, the LM test may be used to test for higher order autoregression and moving average (ARMA) errors and is applicable whether or not there are lagged dependent variables.

The null hypothesis of the LM test is that there is no serial correlation up to lag order, where there is a pre-specified integer. The local alternative is ARMA (r, q) errors, where the number of lag terms = max (r, p). Note that this alternative includes both AR(p) and moving average (MA)(p) error processes, so that the test may have power against a variety of alternative autocorrelation structures (Godfrey 1988).

The test statistics are computed by an auxiliary regression.

$$Y_T = X_T B + E_T$$

Where, B is the estimated coefficients and E are the errors. The test statistic for lag order p is based on the auxiliary regression for the residuals $E = Y - X B$:

$$e_t = x_t \gamma + \left(\sum_{s=1}^p \alpha_s e_{t-s} \right) + v_t$$

Following the suggestion by Davidson and MacKinnon (1993), it sets any pre-sample values of the residuals to 0. This approach does not affect the asymptotic distribution of the statistic, and Davidson and MacKinnon (1993) argue that doing so provides a test statistic which has better finite sample properties than an approach which drops the initial observations.

This is a regression of the residuals on the original regressors and lagged residuals up to order p. Therefore the model reports two test statistics from this test regression. The *F*-statistic is an omitted variable test for the joint significance of all lagged residuals. Because the omitted variables are residuals and not independent variables, the exact finite sample distribution of the *F*-statistic under is still not known, but it presents the *F*-statistic for comparison purposes.

The Obs*R-squared statistic is the Breusch-Godfrey LM test statistic. This LM statistic is computed as the number of observations, times the (un-centred) R^2 from the test regression. Under quite general conditions, the LM test statistic is asymptotically distributed as a $\chi^2(p)$.

The heteroskedasticity test allows you to test for a range of specifications of heteroskedasticity in the residuals of the equation. Ordinary least squares estimates are consistent in the presence of heteroskedasticity, but the conventional computed standard errors are no longer valid. If heteroskedasticity is in evidence, it should either choose the robust standard errors option to correct the standard errors (White 1980) or obtain more efficient estimates using weighted least squares.

There are numbers of different heteroskedasticity tests available for which the custom test wizard to test for departures from heteroskedasticity using a combination of methods. Each of these tests involves performing an auxiliary regression using the residuals from the original equation. These tests are available for equations estimated by least squares, two stage least squares, and nonlinear least squares.

The Breusch-Pagan-Godfrey test was used in this study in order to test heteroskedasticity (Breusch-Pagan, 1979, and Godfrey, 1978). This is a Lagrange multiplier test of the null hypothesis of no heteroskedasticity against heteroskedasticity in the form $\sigma_t^2 = \sigma^2 h(z_t' \alpha)$, where z_t is a vector of independent variables. Usually this vector contains the regressors from the original least squares regression, but it is not necessary.

The test is performed by completing an auxiliary regression of the squared residuals from the original equation on $(1, z_t)$. The explained sum of squares from this auxiliary regression is then divided by $2\sigma^4$ to give an LM statistic, which follows a χ^2 -distribution with degrees of freedom equal to the number of variables in z under the null hypothesis of heteroskedasticity. Koenker (1982) suggested that a more easily computed statistic of Obs*R-squared

(where R^2 from the auxiliary regression) be used. Koenker's statistic is also distributed with degrees of freedom equal to the number of variables in z .

The Residual Diagnostics/Histogram–Normality Test displays descriptive statistics and a histogram of the standardized residuals. The Jarque-Bera statistic was used to test the null of whether the standardized residuals are normally distributed. If the standardized residuals are normally distributed, the Jarque-Bera statistic should not be significant. Then the standardized residuals are leptokurtic and the Jarque-Bera statistic strongly rejects the hypothesis of normal distribution.

3.2 Data Collection

The secondary data published by ABS from 1992 to 2011 (sample of 80 quarterly data over period of 20 years) were analysed and tested in this study. ABS publications are based on information provided by exporters to the Australian Customs and Border Protection Service (Customs and Border Protection). At the time of initial reporting to Customs and Border Protection was estimated quantity and unit price information may be reported for commodities such as iron ore and coal. Final quantity and unit price information are updated progressively in recorded trade data as exporters revise the information provided to Customs and Border Protection. When additional information on quantity and unit price for these commodities were available, the ABS may adjust the balance of payments series to minimise future revisions.

Free on board (FOB) values of Australia's total merchandise exports and FOB values of Australia's merchandise exports to Asia were collected for the period from January 1992 to December 2011 sample of 80 quarterly data over period of 20 years). These data were analysed using above regression models in order to ascertain whether merchandise exports to Asia have any impact on total merchandise exports.

Data in relation to GDP is collated from Australian national accounts published by the Australian Bureau of Statistics. Details on Australian merchandise exports to Asia were sourced from the Australian Bureau of Statistics. FOB values of merchandise exports were taken into consideration in calculating net merchandise exports to Asia during the period 1992 to 2011.

4.1 Data Analysis

Employing an inductive research approach and building an understanding of the case to be studied before developing theoretical constructs required research of Australian economic relations with the Asian region. Secondary data was collected for this analysis from a vast range of published trade statistics in order to gain an overview of the situation. In this manner the analysis of the case provided an understanding of the development of the current relationship allowing an insight into the factors that have shaped it.

Various considerations needed to be adhered to when using secondary data, to ensure its reliability. Taking into consideration the warnings of the perils of secondary data that has been collected for other research purposes, the construct validity of such data may be inaccurate for the research parameters and this must be carefully checked. Other aspects such

as the political motivation for the data collection must be considered and assessed as to how it affects its presentation. Although the data used for this research is secondary, it is raw and therefore not collected for any particular purpose other than the systematic presentation of data for research requirements. In this way the influence of other agendas on the data is marginal. The importance of checking the actual reliability of the data, in relation, for example, to the care taken in systematically collecting and recording and dealing with missing data. The data for this research was collected through the Australian Bureau of Statistics. The statistics published by ABS were collated and presented with the absolute minimum of errors and correct procedures for the collection and presentation are adhered to.

A number of spread sheets were designed for this research and through this method, merchandise exports, merchandise exports to Asia, and similar construct of spreadsheets for each State and Territories in order to capture required data. Because different sources of ABS catalogue data were used for the compilation of statistics for this research it was necessary to ensure this data was comparable.

FOB values of Australian merchandise trade were used to indicate export activity from Australia to the Asian region. There are a number of reasons why this measure was used rather than the alternative. First of all, the FOB value of merchandise trade is the most commonly used measure and the most often cited. It is therefore relevant to use the same measure for comparative reasons. Secondly, FOB values of merchandise trade provide a more reliable indication as it is not as erratic as other measures. The export trade that includes the service sector can differ dramatically across the years and may hinder the comparison and analysis of this research. The exports data are not a real indication of the activity either as the figures may include new ventures or increased capital to existing ventures. Furthermore it does not give any indication to the actual extent of activity at present there are large numbers of service sector activities involved in e-base activities. Similarly, income credits are dramatically different across the years. Income credits likewise do not provide a reliable indication of the extent of activity as they only measure the amount of money earned. There may be more or less profits made by a venture but this is not captured in this measurement. FOB values of merchandise trade is therefore the most efficient measure of activity in the foreign location as they provide a real indication of the extent of export revenue from activities researched in this study.

For the purpose of comparing merchandise exports to the Asian region, Australian merchandise exports during the period 1992 to 2011 (sample of 80 quarterly data over period of 20 years) was analysed in order to examine the economic benefits from Asian trade. While export revenue from trade with Asia would provide a more direct comparison to exports, this sort of data is not collected at a national level and therefore an alternative measure must be used. The FOB values of merchandise exports and the FOB values of Australian Merchandise exports to Asia shows the level of interest in the Asian region through this nature of comparability. The purpose of this comparison for this research is to determine the different ways of ascertaining economic benefits from Asian trade. The significance of the influence of Australian net merchandise exports to Asia in relation to Australian GDP was examined in this study.

4.2 Formulating the Population

Before any research could be conducted on the Australian merchandise exports to the Asian region, it was necessary to identify those countries in the region. Careful consideration was

given to identify those countries in the ABS catalogue data, as there are no specific data sets to identify merchandise exports to the Asian region as a whole. Therefore, more extensive analysis was necessary to determine the population.

Qualitative data was sourced from ABS yearbooks and periodic publications of treasuries of individual State and Territories.

4.3 Electronic Data Processing

Electronic data processing was used to aid in analysing the data. Microsoft Excel and e-views statistical package were used for various procedures. E-Views is a software package especially designed for time series, cross-section, or longitudinal data. E-Views have the capacity to manage data quickly and efficiently in order to perform econometric and statistical analysis, generate forecasts or model simulations, and produce high quality graphs and required tables. Microsoft Excel was used to organise all the quantitative data and to produce tables and figures to aid in analysis through display of relevant data.

The E-views statistical package was used for data analysis and regression modelling. Care was taken in entering the data to ensure no mistakes occurred and data were not entered incorrectly. Data was crosschecked from the entries to the data collection sheets three times on different occasions to ensure its accuracy. The use of electronic data processing greatly aided the analysis.

4.4 Data Analysis and Hypothesis Testing

The thrust of the study is to obtain data pertaining to the economic benefits from Asian trade to the Australian economy. Data analyses was carried out in relation to Australian merchandise exports to Asia and Australian merchandise exports to Asia in relation to Australian GDP. A sample of secondary data in relation to Australian merchandise exports and its proportion of exports to the Asian region along with the Australian GDP and the Australian net merchandise exports to Asia for two decades from January 1992 to December 2011 are taken into consideration. The null hypothesis (H_0) of hypothesis 2: 'Trade with Asian countries does not improve Australian GDP' was tested in order to examine the influence of Australian net merchandise exports to Asia in relation to Australian GDP during the above period.

4.5 Australian Gross Domestic Products and Australian Merchandise Exports to Asia

Gross Domestic Product can be derived by three broad approaches: the income approach (I), the expenditure approach (E) and the production approach (P). While each measure should, conceptually, deliver the same estimate of GDP, if the three measures are compiled independently using different data sources then different estimates of GDP result. However, the Australian national accounts estimates have been integrated with annual balanced supply and use tables. These tables have been compiled from 1994-95, up to the year preceding the latest complete financial year. As integration with balanced supply and use tables ensures that the same estimate of GDP is obtained from the three approaches, annual estimates using the I, E and P approaches are identical for the years for which these tables are available in the Australian national accounts published by the Australian Bureau of Statistics.

The expenditure approach is used in this study for quarterly GDP figures and it also shows the export income and import expenditure separately. GDP using the expenditure approach is derived as the sum of all final expenditure, changes in inventories and exports of goods and services less imports of goods and services. Volume estimates were derived for each of the components as well as for their sum.

The international trade balance is the calculated difference between total goods and services exported and total goods and services imported during a given period of time. This figure is also known as the net trade balance. The net trade balance can be either surplus or deficit. If the total goods and services exported are greater than the goods and services which are imported in a given period of time. A net trade deficit occurs when the goods and services exported are less than the goods and services imported in a given period of time.

Australian quarterly GDP and trade balances of merchandise exports and imports (net merchandise exports) from the Asian sector are sourced from secondary data available from the Australian Bureau of Statistics (Table 4.1). These figures are also shown graphically in figure 4.1.

Table 4.1**Australian GDP and Australian Merchandise Exports to Asia 1992 - 2011**

Period	Australia GDP AUD \$ Mn	Australia Merchandise Exports to Asia AUD\$ Mn	Period	Australia GDP AUD \$ Mn	Australia Merchandise Exports to Asia AUD\$ Mn
Mar-1992	102831	8294	Mar-2002	184329	17521
Jun-1992	105734	9171	Jun-2002	192510	17711
Sep-1992	107548	9610	Sep-2002	195734	18916
Dec-1992	115970	10533	Dec-2002	208566	18475
Mar-1993	108622	9743	Mar-2003	194825	16387
Jun-1993	112357	10009	Jun-2003	201786	15678
Sep-1993	112924	10292	Sep-2003	207352	15765
Dec-1993	122150	11144	Dec-2003	223097	16346
Mar-1994	113997	10160	Mar-2004	210403	15960
Jun-1994	118430	10855	Jun-2004	218635	19096
Sep-1994	121866	10786	Sep-2004	223789	19359
Dec-1994	129359	11432	Dec-2004	237505	19801
Mar-1995	119702	11060	Mar-2005	224593	19428
Jun-1995	125498	11854	Jun-2005	235012	23592
Sep-1995	128287	12580	Sep-2005	242281	23962
Dec-1995	139447	12706	Dec-2005	258590	25315
Mar-1996	128553	12595	Mar-2006	241320	23499
Jun-1996	133418	12741	Jun-2006	252613	26957
Sep-1996	135776	12681	Sep-2006	261628	28756
Dec-1996	146548	12840	Dec-2006	279700	28656
Mar-1997	133410	12663	Mar-2007	264065	26408
Jun-1997	141247	13626	Jun-2007	277666	28655
Sep-1997	143726	14110	Sep-2007	283510	27704
Dec-1997	155328	14921	Dec-2007	303852	28458
Mar-1998	142283	12111	Mar-2008	285546	28842
Jun-1998	148008	13248	Jun-2008	303041	36149
Sep-1998	151709	13314	Sep-2008	314540	42758
Dec-1998	162440	13579	Dec-2008	328961	47171
Mar-1999	151257	12272	Mar-2009	301454	39451
Jun-1999	156118	12312	Jun-2009	307264	36435
Sep-1999	159543	13249	Sep-2009	311261	35039
Dec-1999	170110	14348	Dec-2009	331456	35553
Mar-2000	163242	14858	Mar-2010	313628	35612
Jun-2000	169142	16502	Jun-2010	337035	45664
Sep-2000	173643	17745	Sep-2010	342604	49120
Dec-2000	181227	19705	Dec-2010	360791	48018
Mar-2001	173277	17622	Mar-2011	336219	45183
Jun-2001	178748	19113	Jun-2011	359444	51539
Sep-2001	183346	19535	Sep-2011	364964	55060
Dec-2001	194763	18956	Dec-2011	380407	54613

Source: Author's presentation based on Australian Bureau of Statistics Cat. # 5368.0 *International Trade in Goods and Services Australia*, and Cat. # 5206.0 *Australian National Accounts*

Figure 4.1

Australian GDP and Australian Merchandise Exports to Asia 1992 – 2011



Source: Author's presentation based on Australian Bureau of Statistics Cat. # 5368.0 *International Trade in Goods and Services Australia*, and Cat. # 5206.0 *Australian National Accounts*

4.6 Reliability of testing the data.

A regression model was constructed in order to test time series data collated for the data analysis. If the corresponding p-value of R-Squared statistical value is less than 5 per cent, it is considered as significant. The R-squared value shows the significance of the influence of an independent variable in relation to its dependent variable. However, the regression model was further tested to make sure that the model is free of stationary making sure that the Dublin- Watson Statistical value is greater than the value of R-squared. Breusch-Godfrey Serial Correlation LM Test and Breusch-Pagan-Godfrey heteroskedasticity test is carried out to check whether the regression model has no serial correlation in its residuals. If the residuals are subject to serial correlation, then the first difference method is applied in order to remove serial correlation from the residual. The Histogram Normality test is carried out to check whether the residual is normally distributed. If the Jarque-Bera value and the correspondent probability are high, then the regression model is considered as it has a normally distributed residual.

4.7 Testing Hypothesis

Hypothesis is aims to test the demographic variables of the relationship between Australian merchandise exports to Asia in relation to Australian GDP during the period 1992 to 2011.

The null hypothesis (H0) of hypothesis: 'Trade with Asian countries does not improve Australian GDP'.

The testing process was organised in the following steps.

Step 1: Specification of the Null and Alternative Hypotheses

The null hypothesis (H0) is constructed as;

(H0) of the hypothesis: 'Trade with Asian countries does not improve Australian GDP'.

Step 2: Selection of test statistics

A regression model with a high value of R-squared, which has a correspondent p-value of less than 5 per cent, was considered. P value is the probability. The smaller the p-value, the more strongly the test rejects the null hypothesis, that is, the hypothesis being tested. A p-value of .05 or less rejects the null hypothesis at the 5% level.

Then the regression model is selected if it is free of serial correlation and heteroskedasticity in its residuals and the residuals are normally distributed.

Step 3: Determination of level of significance

The level of significance (p-value) is set at five per cent. If the corresponding p-value of the observed R-squared value is less than five per cent it is considered as significant. Value of the R-squared shows the significance of influence that the independent variable has in relation to its dependent variable.

Step 4: Application of test statistics

Statistical tests mentioned in Step 2 above was carried out testing secondary data in relation to Australian merchandise exports and Australian GDP for the period 1992 to 2011. This statistic test examined the relationship between the Australian merchandise export revenue and Australian GDP.

The E-views (see chapter 5) statistical package was used in order to carryout the above statistical tests.

4.8 Testing Hypothesis

Hypothesis is aims to test the demographic variables of the relationship between Australian merchandise exports to Asia in relation to Australian GDP during the period 1992 to 2011.

The null hypothesis (H0) of hypothesis: 'Trade with Asian countries does not improve Australian GDP'.

4.9 Data analysis of Australian GDP and Australian Merchandise Exports to Asia 1992 to 2011

Total Australian GDP and Australian merchandise exports to Asia are analysed using e-views statistical package. A regression model is constructed in line with essential criteria such as high R square value, no serial correlation in the residual, no heteroskedasticity in the residual and residuals, are normally distributed.

The following initial regression model was constructed having dependent variable Y and independent variable X where;

Y = Australian GDP 1992 to 2011

X = Australian merchandise exports to Asia 1992 to 2011.

C = Intercept.

Test results revealed that 98.33 per cent of total Australian merchandise exports to Asia were influenced by the Australian GDP during the period 1992 to 2011. The corresponding p-value of the independent variable is less than 5 per cent, which is considered as statistically significant (Appendix 5). Further tests were carried out to ascertain whether the regression model complied with essential criteria.

The Breusch-Godfrey Serial Correlation LM Test with two lags was carried out to check whether the residual has serial correlation. The p-value of the observed R-squared was less 5 per cent. Therefore the model is considered as having serial correlation (Appendix 6).

The Breusch-Pagan-Godfrey heteroskedasticity test was carried out to ascertain whether the residual has heteroskedasticity. Test results found that the p-value of observed R-squared was less than 5 per cent. Therefore the model is considered as having heteroskedasticity (Appendix 1).

The final test was carried out to check whether the residual is normally distributed. The Jarque-Bera value and the associated p-value were greater than 5 per cent. Therefore the residual is considered as normally distributed (Appendix 2). However the residual of the regression model has serial correlation and heteroskedasticity. Therefore the regression model needs further steps to remove serial correlation and heteroskedasticity.

The regression model was re-tested introducing first difference method with one lag in order to remove serial correlation existing in the residuals. The first difference was introduced from the origin removing the intercept (C).

Test results revealed that the R-squared value as 41.08 per cent highlighting that the Australian merchandise exports to Asia influenced the Australian GDP during the period 1992 to 2011. The p-value of the independent variable is less than 5 per cent that is significant to support the R squared value (Table 4.2)

Table 4.2**Australian GDP and Australian merchandise exports to Asia 1992 to 2011****Regression analysis with first difference**

Dependent Variable: D(Y)

Method: Least Squares

Date: 11/28/12 Time: 18:09

Sample (adjusted): 9/01/1992 12/01/2011

Included observations: 78 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(X)	2.778448	0.417716	6.651518	0.0000
D(Y(-1))	-0.236887	0.088122	-2.688180	0.0088
R-squared	0.410868	Mean dependent var	3521.449	
Adjusted R-squared	0.403116	S.D. dependent var	11265.14	
S.E. of regression	8703.252	Akaike info criterion	21.00609	
Sum squared resid	5.76E+09	Schwarz criterion	21.06652	
Log likelihood	-817.2374	Hannan-Quinn criter.	21.03028	
Durbin-Watson stat	2.065251			

Source: Author's calculations using data available from ABS Cat # 5368.0 *International Trade in Goods and Services* and Cat. # 5206.0 *Australian National Accounts*.

The Breusch-Godfrey Serial Correlation LM Test with two lags was carried out in order to ascertain whether the residual has serial correlation in the above regression model. The p-value of the observed R-squared was 100 per cent, which is greater than 5 per cent. Therefore the model is considered as having no serial correlation (Table 4.3).

Table 4.3**Australian GDP and Australian merchandise exports to Asia 1992 to 2011****Regression analysis with first difference: Breusch-Godfrey Serial Correlation LM Test**

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.665243	Prob. F(2,74)	0.0763
Obs*R-squared	0.000000	Prob. Chi-Square(2)	1.0000

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 11/28/12 Time: 18:11

Sample: 9/01/1992 12/01/2011

Included observations: 78

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(X)	0.388181	0.533214	0.728003	0.4689
D(Y(-1))	-0.214307	0.184258	-1.163079	0.2485
RESID(-1)	0.181512	0.251123	0.722800	0.4721
RESID(-2)	-0.385597	0.181699	-2.122178	0.0372
R-squared	-0.034946	Mean dependent var	2698.856	
Adjusted R-squared	-0.076904	S.D. dependent var	8208.804	
S.E. of regression	8518.602	Akaike info criterion	20.98781	
Sum squared resid	5.37E+09	Schwarz criterion	21.10867	
Log likelihood	-814.5247	Hannan-Quinn criter.	21.03619	
Durbin-Watson stat	1.939132			

Source: Author's calculations using data available from ABS Cat # 5368.0 *International Trade in Goods and Services* and Cat. # 5206.0 *Australian National Accounts*.

The Breusch-Pagan-Godfrey heteroskedasticity test was carried out to ascertain whether the residual has heteroskedasticity in the regression model. The test results found that the p-value of observed R-squared was 19.83 per cent, which is greater than five per cent. Therefore the model is considered as having no heteroskedasticity in its residuals (Table 4.4).

Table 4.4**Australian GDP and Australian merchandise exports to Asia 1992 to 2011****Regression analysis with first difference: Heteroskedasticity Test: Breusch-Pagan-Godfrey**

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.622851	Prob. F(2,75)	0.2042
Obs*R-squared	3.235510	Prob. Chi-Square(2)	0.1983
Scaled explained SS	3.219000	Prob. Chi-Square(2)	0.2000

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 11/28/12 Time: 18:12

Sample: 9/01/1992 12/01/2011

Included observations: 78

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	70207716	13430155	5.227618	0.0000
D(X)	-3132.905	5448.994	-0.574951	0.5670
D(Y(-1))	1613.323	1166.478	1.383071	0.1707
R-squared	0.041481	Mean dependent var	73804378	
Adjusted R-squared	0.015920	S.D. dependent var	1.08E+08	
S.E. of regression	1.07E+08	Akaike info criterion	39.84627	
Sum squared resid	8.54E+17	Schwarz criterion	39.93692	
Log likelihood	-1551.005	Hannan-Quinn criter.	39.88256	
F-statistic	1.622851	Durbin-Watson stat	1.919642	
Prob(F-statistic)	0.204187			

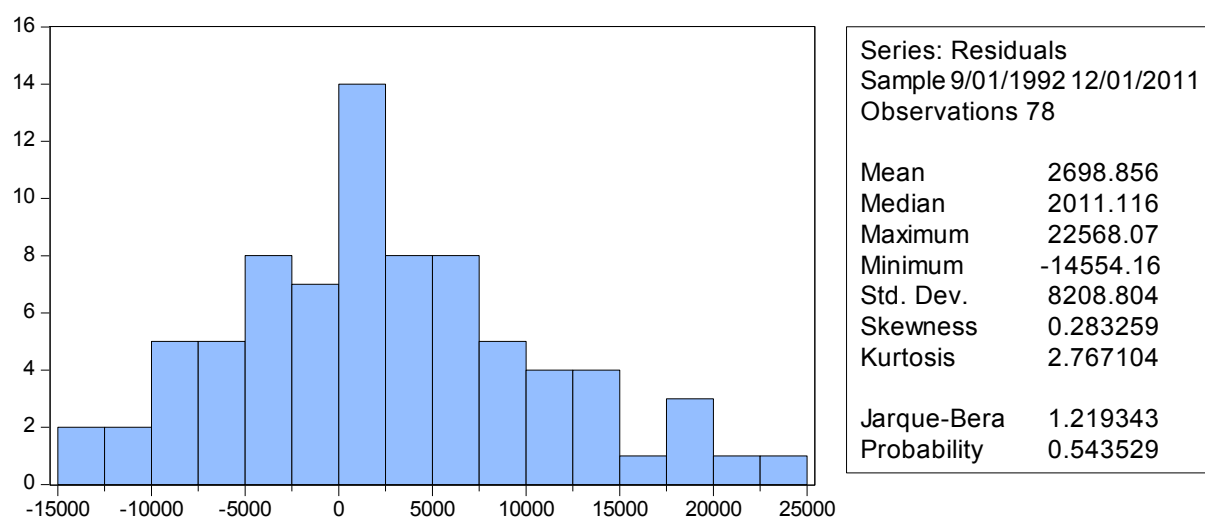
Source: Author's calculations using data available from ABS Cat # 5368.0 *International Trade in Goods and Services* and Cat. # 5206.0 *Australian National Accounts*

The final test was carried out to check whether the residual is normally distributed in the regression model. The Jarque-Bera value was 1.219343 and the associated p-value was 54.35 per cent, which is greater than 5 per cent. Therefore the residual is considered as normally distributed (Figure 4.2).

Figure 4.2

Australian GDP and Australian merchandise exports to Asia 1992 to 2011

Regression analysis with first difference: Histogram Normality test

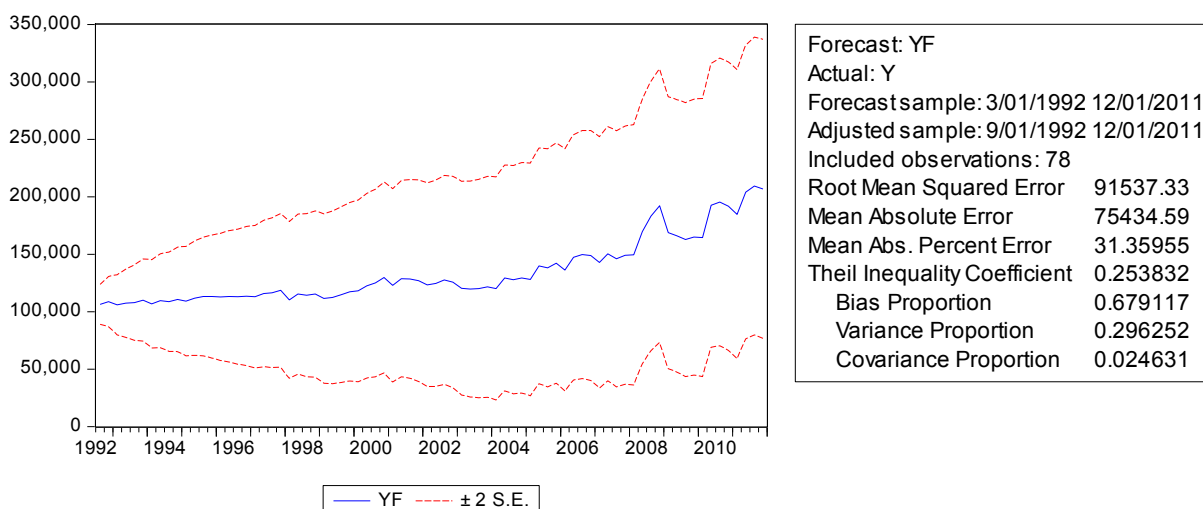


Source: Author's calculations using data available from ABS Cat # 5368.0 *International Trade in Goods and Services* and Cat. # 5206.0 *Australian National Accounts*

Therefore the regression analysis with first difference method reveals that the Australian merchandise exports to Asia had a significant influence in relation to the Australian GDP during the period 1992 to 2011. Figure 4.3 shows the forecast of Australian GDP and merchandise export to Asia.

Figure 4.3

Forecast of Australian GDP and Australian merchandise exports to Asia 1992 to 2011



AUS\$ Million/Period

Source: Author's calculations using data available from ABS Cat # 5368.0 *International Trade in Goods and Services* and Cat. # 5206.0 *Australian National Accounts*.

5.1 Discussion of Test Results

Economic benefits from Asian trade to Australian economy in terms contribution to improve Australian GDP was tested using a hypotheses. Null hypothesis (H0): 'Trade with Asian countries does not improve Australian GDP'.

Asia is a region of great diversity across ethnic groups, languages, history, institutions and natural endowments. Its transformation into the world's most dynamic economic region has been a defining development (DFAT 2012).

5.2 Discussion of test results of the hypothesis

Hypothesis focuses on the exports (X). Exports consist of merchandise and services in a given period of time. Similarly the imports consist of merchandise and services in a given period of time. This research study focuses on merchandise export sector. The Australian economy directly benefits from Asian trade if there was surplus in the merchandise export sector. Therefore data analysis is carried out in order to ascertain the significance of Australian exports to Asia in relation to the Australia's GDP during the period 1992 to 2001.

The null hypothesis (H0): 'Trade with Asian countries does not improve Australian GDP'. The hypothesis was tested using data a set in relation to the Australia's merchandise exports to Asia and the Australian GDP during the period 1992 to 2011. This data set was tested using a regression model. Regression model with free of serial correlation and heteroskedasticity in the residuals, and a normally distributed was taken into consideration. The Breusch-Godfrey LM test was carried out in order to test whether residuals of the regression model was subject to serial correlation. The first difference method with necessary lags was applied in order to remove such serial correlation. The heteroskedasticity test is carried out to test for a range of specifications of heteroskedasticity in the residuals of the equation. The Histogram-Normality test was carried out to check whether the residuals

are normally distributed. The R-squared value with significant p-value (less than 5 per cent) was considered as an acceptable test result.

Test results of the regression analysis pertaining to Australian merchandise exports to Asia and Australian GDP suggests that there is a significant relationship between these two variables. The R-squared value is 0.41 and the correspondent p-value is 0.0000 (less than 5 per cent). The test result suggests that 41 per cent of the Australian merchandise exports to Asia influenced the Australian GDP during the period 1992 to 2011 (Table 5.1).

Table 5.1

Summary of Statistical test results – Australian Merchandise Exports to Asia and the Australian GDP, 1992 to 2011

Independent variables/test statistics	GDP/merchandise exports to Asia
D(X)	2.78
D(Y(-1))	-0.24
p-value	0.00
R-Squared	0.41
S.E. of regression	8703
Dublin-Watson Stat	2.06
BGLMS	100%
HT	19%
NORM	1.21

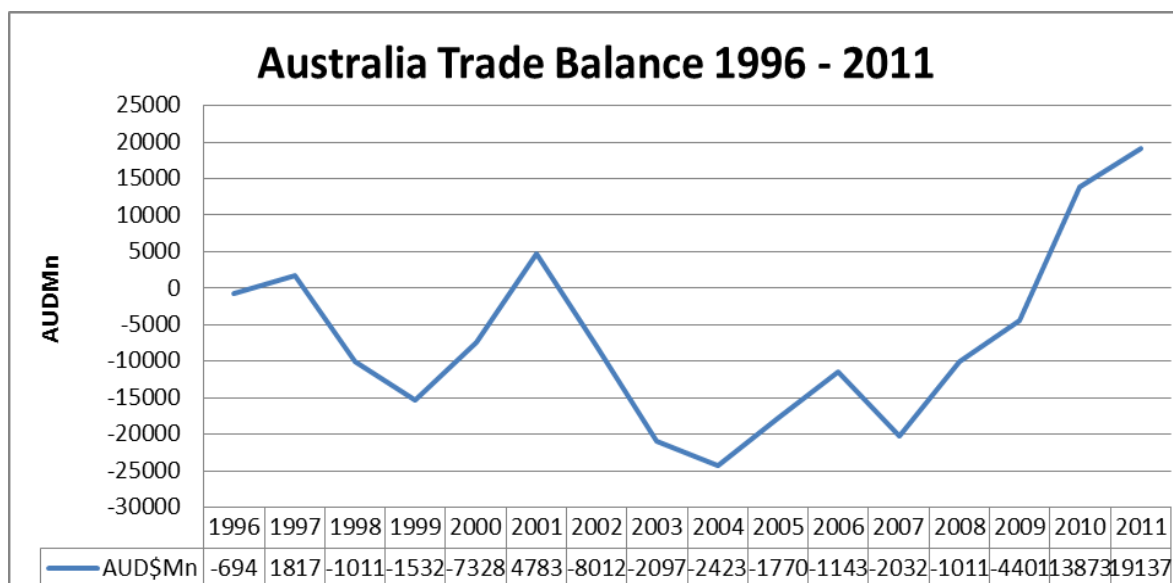
Source: Author's calculations using data available ABS Cat # 5368.0 *International Trade in Goods and Services* and Cat. # 5206.0 *Australian National Accounts*.

5.3 Discussion of Australia's Merchandise Exports to Asia in relation to Australia's Total Merchandise Exports/Australian GDP

As explained in 'in the black' publication of CPA Australia (2012), for the month of December 2011, Australia's trade surplus was A\$1.7 billion, up from A\$1.3 billion in November 2012. Imports rose one per cent in December, mainly from cars and fuel, while exports were up 2.2 per cent, due to an increase in exports of gold and higher coal earnings. Australia has only recently begun to enter trade surpluses (Figure 51). The reason for this shift has been the surging demand for minerals from China. The move into surplus coincided with a sharp increase in exports to China beginning in 2008 (Figure 5.2). The move also coincided with a significant increase in the percentage of Australian exports coming from minerals, particularly coal and iron ore (Figure 5.3).

Figure 5.1

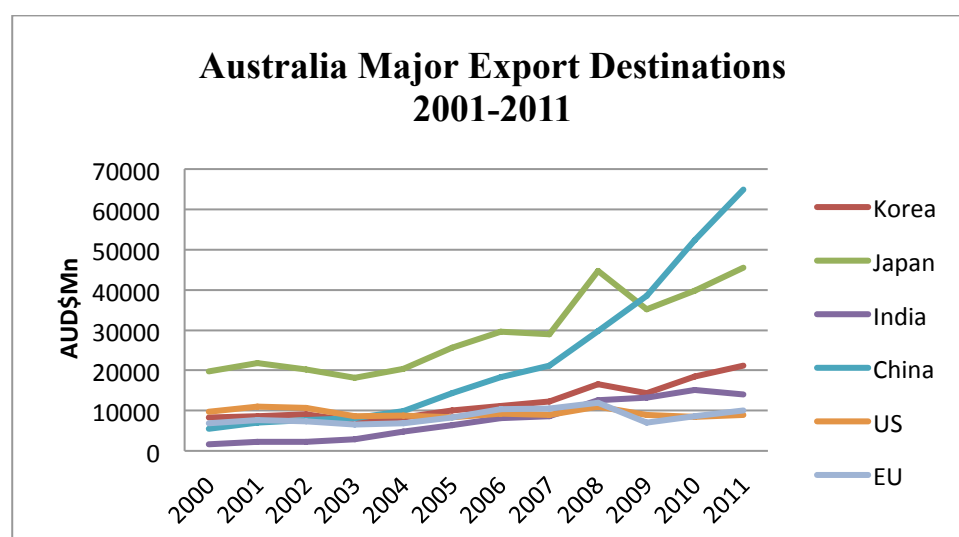
Australia Trade Balance, 1996 to 2011



Source: CPA Australia based on ABS Cat # 5368.0 *International Trade*

Figure 5.2

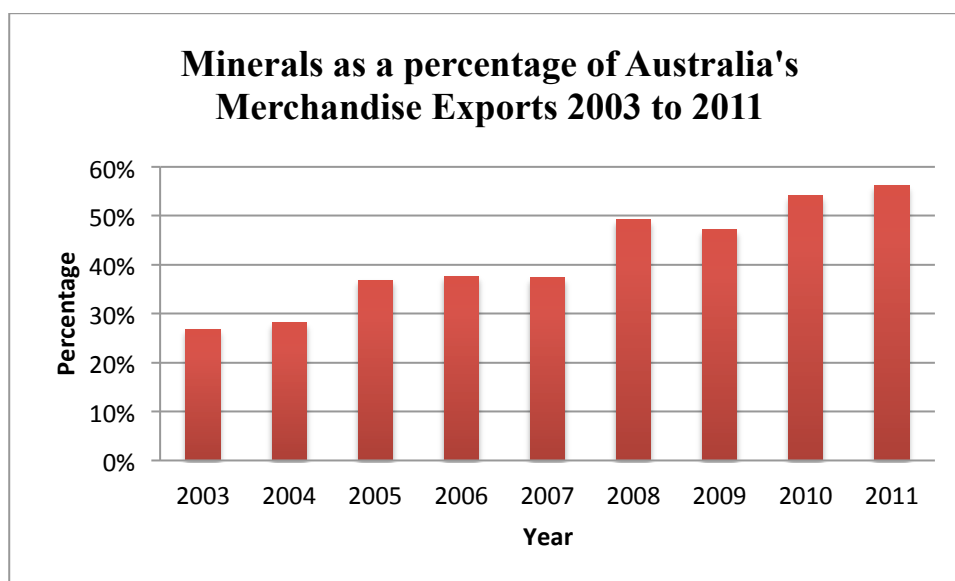
Australia Major Export Destinations 2000-2011



Source: CPA Australia based on ABS Cat # 5368.0 *International Trade*

Figure 5.3

Minerals as a Percentage of Australia's Merchandise Exports 2003 to 2011



Source: CPA Australia based on ABS Cat # 5368.0 *International Trade in Goods and Services 2003 to 2011*

6.1 Conclusion

Majority opinion in policy circles in Australia is that the Australian economy has substantial benefits from trade with the Asia. However, there are very limited research and analytical studies available in order to substantiate such a claim.

Therefore, the main purpose of carrying out of this research study was to ascertain the validity of claim that the Australian economy benefits from trading with Asia. The statistical analysis was carried out in relation to the Australia's merchandise exports to Asia and Australian during the period of 1992 to 2011. These analysis and tests were carried out using secondary data sourced from the Australian Bureau of Statistics.

The null hypothesis (H0): 'Trade with Asian countries does not improve Australian GDP' was examined with a data set of Australia's merchandise exports to Asia and the Australia's GDP during the period 1992 to 2011.

The first difference method was applied in order to remove serial correlation from the residual. The Histogram Normality test was carried out to check whether the residual is normally distributed. Breusch-Godfrey Serial Correlation LM Test and the Breusch-Pagan-Godfrey heteroskedasticity test was carried out to check whether the regression model has no serial correlation in its residuals.

Hypothesis was tested using a data set of the Australian GDP and Australian merchandise exports to Asia during the period 1992 to 2011. Test result shows that the p-value is less five per cent with R-squared value of 0.410868. This test results revealed that the Australian merchandise exports to Asia has an influence of 41.08 per cent in relation to the Australia's GDP during this period. The above test results were substantiated with secondary information.

The statistical test results together with secondary information pertaining to Hypothesis reject the null hypothesis (H0): 'Trade with Asian countries does not improve Australian GDP'.

6.2 Recommendations

The findings of this study are based on secondary quantitative data extracted from the Australian Bureau of Statistics together with secondary information sourced from different publications. Following recommendations are suggested:

1. The formation of a sustainable strategy in relation to the export industry.
 - The formulation of strategies in relation to the export industry for the next 15 to 20 years in order to win investor confidence.
 - The enhanced bi-lateral and trade negotiations with the emerging economies in the Asian region.
2. The provision of facilities and funding availability for further research into the export trade.
3. The promotion of value-added and innovative industries in order to create further employment in Australia.
4. The development of infrastructure such as roads, railways and harbours providing enhanced facilities for the export trade.
5. A detailed examination of the outcome of Free Trade Agreements (FTA) with Asian countries in order to ascertain the economic benefits to the Australian economy.

6.3 Limitation of the study and suggestions for future research

The quantitative data considered in this thesis covers two decades from 1992 to 2011. The export trend recorded in the period, which was considered in this study, may have changed in 2012 and beyond due to economic draw back in some of the Asian countries as well as the continuous increase in exchange rate in the Australia against other major currencies.

Overall the thesis provides some insight into the economic benefits from Asian trade to the Australian economy with the following limitations.

- Since this research focus was on the export revenue from the Asian trade that is an integral part of the Australian GDP, obtaining relevant data in relation to exports to the Asian region was a difficult task. Therefore merchandise exports were considered as country-wise export data was available from the Australian Bureau of Statistics.
- All data pertaining to individual countries were screened to remove data pertaining to other countries that do not belong to the Asian region. All care was taken to minimise any calculation errors. Excel formulas were created in order to capture relevant data.

This study analysed and tested the total Australian merchandise export revenue against the Australian GDP during the period 1992 to 2011.

Some of the issues raised in the limitations could be the subjects of further study to be undertaken to build upon the findings of the current study. Future studies could involve research into various other economic benefits rather than restricting them to export revenue.

Appendix 1

Australian GDP and Australian merchandise exports to Asia 1992 - 2011

Dependent Variable: Y

Method: Least Squares

Date: 12/07/12 Time: 07:51

Sample (adjusted): 6/01/1992 12/01/2011

Included observations: 79 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11935.31	4214.734	2.831807	0.0059
X	1.165147	0.287966	4.046126	0.0001
Y(-1)	0.834679	0.046013	18.13987	0.0000
R-squared	0.983315	Mean dependent var		208363.7
Adjusted R-squared	0.982876	S.D. dependent var		78394.63
S.E. of regression	10258.67	Akaike info criterion		21.34687
Sum squared resid	8.00E+09	Schwarz criterion		21.43685
Log likelihood	-840.2013	Hannan-Quinn criter.		21.38292
F-statistic	2239.484	Durbin-Watson stat		2.637388
Prob(F-statistic)	0.000000			

Appendix 2

Australian GDP and Australian merchandise exports to Asia 1992 - 2011

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	7.577811	Prob. F(2,74)	0.0010
Obs*R-squared	13.42926	Prob. Chi-Square(2)	0.0012

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 12/07/12 Time: 07:57

Sample: 6/01/1992 12/01/2011

Included observations: 79

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4656.742	4895.467	-0.951235	0.3446
X	-0.416286	0.362476	-1.148450	0.2545
Y(-1)	0.066988	0.058915	1.137028	0.2592
RESID(-1)	-0.358967	0.152111	-2.359903	0.0209
RESID(-2)	0.173997	0.129193	1.346801	0.1822
R-squared	0.169991	Mean dependent var		6.10E-12
Adjusted R-squared	0.125125	S.D. dependent var		10126.29
S.E. of regression	9471.600	Akaike info criterion		21.21118
Sum squared resid	6.64E+09	Schwarz criterion		21.36115
Log likelihood	-832.8417	Hannan-Quinn criter.		21.27126
F-statistic	3.788905	Durbin-Watson stat		2.005230
Prob(F-statistic)	0.007392			

Appendix 3

Australian GDP and Australian merchandise exports to Asia 1992 - 2011

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	12.83336	Prob. F(2,76)	0.0000
Obs*R-squared	19.94430	Prob. Chi-Square(2)	0.0000
Scaled explained SS	23.91106	Prob. Chi-Square(2)	0.0000

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 12/07/12 Time: 07:58

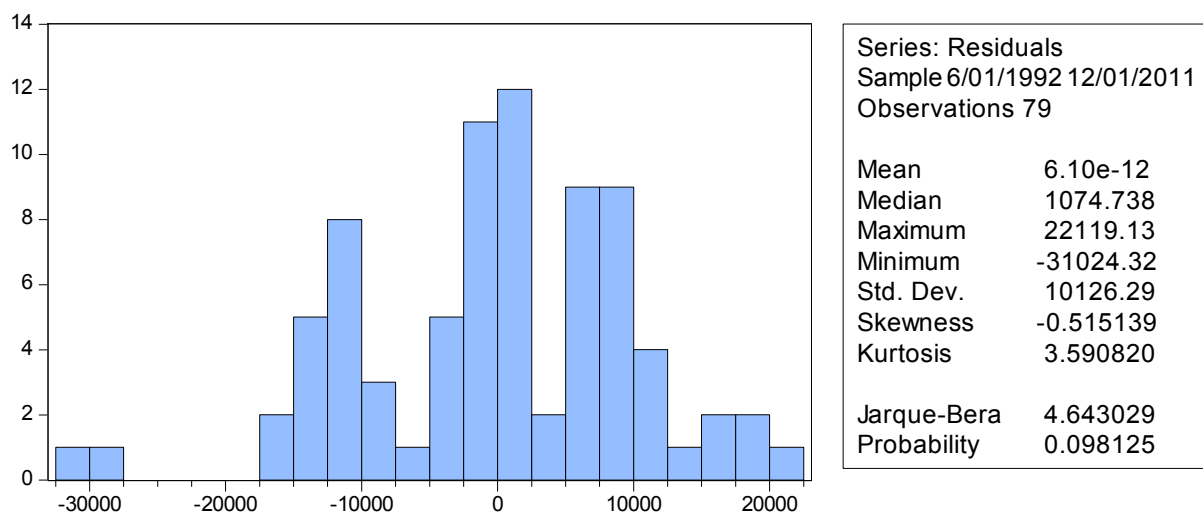
Sample: 6/01/1992 12/01/2011

Included observations: 79

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.85E+08	59018789	-3.137703	0.0024
X	-11725.46	4032.382	-2.907825	0.0048
Y(-1)	2648.213	644.3255	4.110055	0.0001
R-squared	0.252459	Mean dependent var	1.01E+08	
Adjusted R-squared	0.232787	S.D. dependent var	1.64E+08	
S.E. of regression	1.44E+08	Akaike info criterion	40.44092	
Sum squared resid	1.57E+18	Schwarz criterion	40.53090	
Log likelihood	-1594.416	Hannan-Quinn criter.	40.47697	
F-statistic	12.83336	Durbin-Watson stat	2.407257	
Prob(F-statistic)	0.000016			

Appendix 4

Australian GDP and Australian merchandise exports to Asia 1992 - 2011



References

- Arize, A. C, 1987, "The Supply and Demand for Imports and Exports in a Simultaneous Model", *Applied Economics*, vol. 19, pp.1233-1247
- Athukorala, P, 2000, "Manufactured Exports and Terms of Trade of Developing Countries: Evidence from Sri Lanka," *The Journal of Development Studies*, vol. 36, no.5, pp.89-104.
- Athukorala, P. and J. Riedel, 1991, "The Small Country Assumption: A Reassessment with Evidence from Korea", *WeltwirtschaftlichesArchiv*, vol. 127, pp.138-151.
- Australia, Department of Foreign Affairs and Trade, (DFAT), 2003, *Globalization: Keeping the Gains*, The Department, Economic Analytical Unit, Canberra.
- , 2003, *Country Fact Sheet* (Canberra: The Department).
- , 2010, *Country Fact Sheet*, (Canberra: The Department).
- , 2011, *Country Fact Sheet* (Canberra: The Department).
- , 2011-12, *Country Fact Sheet* (Canberra: The Department).
- , 2012, *Australia – Trading with the World* (Canberra: The Department). Trade Matters [online] available at <http://www.dfat.gov.au/tradematters/> [Accessed December 2012]
- , Market Information & Research Section, 2012, *Fact Sheet* (Canberra: DFAT) [online]: Available at <http://www.dfat.gov.au/geo/fs/> [Accessed November 2012]
- Australian Bureau of Statistics (ABS), 1998, *Business Longitudinal Survey in 1997-98* [online]: Available at [http://www.abs.gov.au/websitedbs/d3310114.nsf/4a256353001af3ed4b2562bb00121564/f7739966adba7636ca2572030016614c/\\$FILE/1994-95%20to%201997-98%20CURF%20docoV2.pdf](http://www.abs.gov.au/websitedbs/d3310114.nsf/4a256353001af3ed4b2562bb00121564/f7739966adba7636ca2572030016614c/$FILE/1994-95%20to%201997-98%20CURF%20docoV2.pdf). [Accessed 13 March 2012].
- 1985, *Year Book 1985* Catalogue Number 1301.0, ABS, Canberra.
- 2002, *Year Book 2002*, Catalogue Number 1301.0, ABS, Canberra.
- 2003, *Year Book 2003*, Catalogue Number 1301.0, ABS, Canberra.
- 2004, *Year Book 2004*, Catalogue Number 1301.0, ABS, Canberra.
- 2007, *Year Book 2007*, Catalogue Number 1301.0, ABS, Canberra.
- 2012, *Labour Force Australia*, Catalogue Number 6202.0, ABS, Canberra.
- 2012, *International Trade in Goods and Services*, Catalogue Number 5368.0, ABS, Canberra.
- 2012, *Australian Population Clock*, ABS, Canberra.
- Barbara, I, 2004, *International Economics*, Persons Education, Australia.
- Barrie, D. and M. David, 1990, *Australia in the International Economy*, Cambridge University Press, Cambridge.
- Bleaney, M. F and H. Greenaway, 1993, "Long-run Trends in the Relative Price of Primary Commodities and in the Terms of Trade of Developing Countries," *Oxford Economic Papers*, vol. 45, no. 3: 349- 363.
- Breusch, T. S. and A.R. Pagan, 1979, "A Simple Test for Heteroskedasticity and Random Coefficient Variation," *Econometrica*, vol. 48: 1287–1294.
- CPA Australia, 2012, Australia Trade Surplus Hits Record High, February 2012. [online] <http://www.itbdigital.com/opinion/2012/02/03/australia-trade-surplus-hits-record-high/> [accessed December 2012]

- Cuddington., I.T, and C. M. Urzua. 1989, 'Trends and Cycles in the Net hailer Terms of Trade: Anew Approach, *Economic Journal*, Vol. 99, pp. 425 - 426.
- Davidson, Russell and James G. MacKinnon, 1993, *Estimation and Inference in Econometrics*, Oxford University Press, Oxford.
- Dornbush, R. and S. Fisher, 1976, *Open Economy Macroeconomics*, Basic Books, New York.
- EconData's DX database, [online] <http://www.econdata.com/>, [accessed March 2012].
- Edward, G. H, 1996, *The Portable Encyclopedia for Doing Business with Australia*, World Trade Press, USA.
- Edwards, R. W and M.T. Skully, 1996, *ASEAN Business Trade and Development*, B-H Asia, Singapore.
- Edwards, R. W and Buckley, P, 1998, "The Choice of Location and mode: The case of Australian investors in the UK", *International Business Review*, vol. 7, no. 4, pp. 503-520.
- Feldstein, M, 2003, *Economic and Financial Crises in Emerging Market Economies*, Chicago: National Bureau of Economic Research & the University of Chicago Press, Chicago.
- Goldstein, M. and M.S. Khan, 1978, "The Supply and Demand for Exports: A Simultaneous Approach," *Review of Economics and Statistics*, vol. 60: 275-286.
- Godfrey, L. G, 1978, "Testing for Multiplicative Heteroscedasticity," *Journal of Econometrics*, vol.8: 227-236.
- Gunawardana, P.J. and P.C. Karn, 1998, *Supply and Demand for Australia's Pharmaceutical Exports*, Working Paper No. 7/98, Victoria University of Technology, Dept. of Applied Economics, Melbourne.
- Gunawardana, P.J, I. Havrila, and S. Khorchurklang, 2008, "Export Demand for Australian Dairy Food in Thailand," *European Journal of Management*, vol. 8: 110-119.
- Gunawardana, P.J. and K. Sharma, 2009b, *The Impact of Inward FDI, Labour Productivity and Industry Assistance on Manufacturing Exports of Australia*, Working Paper Series, WP2009.02, Victoria University, School of Economics and Finance, Melbourne.
- Hayter, R and Wilde, P. D, 1990, *Industrial Transformation and Challenge in Australia and Canada*, Carleton University Press Inc, Canada.
- Kawai, M and G. Wignaraja, 2011, *Asia's Free Trade Agreements: How is Business Responding?*, Edward Elgar, USA.
- Khan, M. S, 1974, "Import and Export Demand in Developing Countries," *IMF Staff Papers*, vol. 21: 678-693.
- Koenker, Roger and Gilbert Bassett, Jr. 1982, "Robust Tests for Heteroskedasticity Based on Regression Quantiles," *Econometrica*, vol. 50, no.1: 43-62.
- Koshal, R. K, V.S. Shukla, and G.P. Koirala, 1992, "Demand and Supply of Indian Exports: A Simultaneous Equation Approach," *Journal of Asian Economics*, vol. 3: 73-83.
- Knight, N and M. Heazlem, 2011, *Understanding Australia's Neighbours: An Introduction to East and Southeast Asia*, Cambridge University Press, New York.

- Mahmood, M, 2002, "Export Demand for Australian Processed Food in Japan," *Journal of International Selling and Sales Management*, vol. 8: 3-12.
- Mahmood, M. and L.J. Ma, 2008, *The Determinants of Chinese Export Performance*, Working Paper Series, WP2008.04, Victoria University, School of Economics and Finance, Melbourne.
- Muscatelli, V.A. and T.G. Srinivasan, T.G, 1992, "Demand and Supply Factors in the Determination of NIE Exports: A Simultaneous Error-Correction Model for Hong Kong," *Economic Journal*, vol. 102: 1467-1477.
- Nelson, C. R and H. Kang, 1984, "Pitfalls in the Use of Time as an Explanatory Variable," *Journal of Business and Economic Statistics*, vol. 2, no. 1: 73-82.
- Prebisch, R, 1950, *The Economic Development of Latin America and its Principal Problems*, UN Commission for Latin America, New York.
- 2012]
- Rodney, T and G. Ross, 2004, *How Australia Compares*, Cambridge: Press Syndicate of University of Cambridge, Cambridge.
- Sawyer, W. C. and Sprinkle, R. L., 1997, "The Demand for Imports and Exports in Japan: A Survey," *Journal of the Japanese and International Economies*, Elsevier, vol. 11-2, pp. 247-259.
- Scott, B. M and L. Jonathan, 2011, *Asia's Rise in the 21st Century*, ABC-CLIO, Santa Barbara California.
- Senhadji, A. and C. Montenegro, 1998, *Time Series Analysis of Export Demand Equations: A Cross-Country Analysis*, Working Paper of the International Monetary Fund, No. 45, IMF, Washington DC.
- Sharma, K, 2003, "Factors Determining India's Export Performance," *Journal of Asian Economics*, vol. 14: 435-446.
- Sinclair, W, 1977, *Australian Economic Development: Old Model and New Model*, University of Western Australia Press, Perth.
- Stockman, A and L. Svensson, 1987, "Capital Flows, Investment and Exchange Rates," *Journal of Monetary Economics*, vol. 19: 171-201.
- White, H, 1980, "A Heteroskedasticity - Consistent Covariance Matrix and a Direct Test for Heteroskedasticity," *Econometrica*, vol. 48: 817-838
- Warr, P. G. and F. Wollmer, 1996, "The Demand for LDC Exports of Primary Commodities: The Case of the Philippines," *Australian Journal of Agricultural Economics*, vol. 40: 37-49.
- World Bank, 1993, *The East Asian Miracle: Economic growth and Public Policy*, World Bank, Washington DC.
- , 2004, *South Asia Region (SAR): India, Country Brief*, [online]: Available at <http://lnweb18.worldbank.org/SAR/sa.nsf/Countries/India/4F3233D642E4BB3985256B4A00706AA7?OpenDocument>. [Accessed November 2011].
- , 2005a, *East Asia Update, April 2005*, World Bank, Washington DC.
- , 2005b, *World Development Indicators 2005* [online]: Available at <http://devdata.worldbank.org/wdi2005/CopyRight.htm> [Accessed November 2011].
- , 2009, *Reshaping Economic Geography: World Development Report*, World Bank, Washington DC.

- World Trade Organisation, (WTO), 2006, *World Trade Report* [online]: Available at http://www.wto.org/english/res_e/publications_e/wtr06_e.htm [Accessed 13 March 2012].
- Yaw, A. Debrah and Ian, G. Smith, 2001, *Work and Employment in a Globalized Era: An Asia Pacific Focus*, Frank Cass, London.